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ENGINEERING DATA TRANSMITTAL

COPY OF ORIGINAL

Page 1 of 1

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2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) A. J. Knepp, Geosciences Group (20) jc 2-21-92	4. Related EDT No: N/A
5. Proj/Prog/Dept/Div: W105/-/EE&G/GG	6. Cog/Proj Engr: W. J. McMahon	7. Purchase Order No: N/A
8. Originator Remarks: The Rapid or Large Leak Rate (RLL) is calculated for LERF basins. The RLL provides an upper limit on the amount of leakage allowed into the drainage layer before the LERF basin must be closed, repaired, or undergo operational changes. The RLL was calculated according to the guidance provided by three EPA documents.		9. Equip/Component No: N/A
		10. System/Bldg/Facility: LERF
11. Receiver Remarks:		12. Major Assm Dwg No: N/A
		13. Permit/Permit Application No. N/A
		14. Required Response Date: N/A

15. **DATA TRANSMITTED**

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-TI-009		0	Calculation of the Rapid or Large Leak Rate for LERF Basins in the 200 East Area	4	2	1	1

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16. **KEY**

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 see MRP 5.43 and EP-1.7	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. **SIGNATURE/DISTRIBUTION** (See Impact Level for required signatures)

(G) Reason	(H) Disp	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp
1/2	1	Cog./Proj. Eng. WJ McMahon	WJ McMahon		H4-56	RJ Julian			R1-48	6	
1/2	1	Cog./Proj. Eng. Mgr. AJ Knepp	AJ Knepp		H4-56	RJ Nicklas			R1-43	3	
		QA N/A				TS Vail			R1-43	3	
		Safety N/A				MA White			R1-43	3	
1/2	1	AG Law			H4-56	RB Wurz			S5-14	3	
						EDMC (2)			H4-22		
						IRM Clearance			H4-17		

18.	19.	20.	21. DOE APPROVAL (if required)
WJ McMahon 11/18/91 Signature of EDT Originator — Date	Authorized Representative for Receiving Organization — Date	AJ Knepp 11/12/91 Cognizant/Project Engineer's Manager — Date	Ltr No. N/A ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

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INFORMATION RELEASE REQUEST

References: WHC-CM-3-4

Purpose

- ☐ Speech or Presentation (Check only one suffix)
  - ☐ Full Paper
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  - ☐ Abstract
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- ☐ Reference
- ☑ Technical Report
- ☐ Thesis or Dissertation
- ☐ Manual
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- ☐ Software/Database
- ☐ Controlled Document
- ☐ Other ____

New ID Number

Existing ID Number (Include revision, volume, etc.) WHC-SD-EN-TI-009, Rev. 0

If previously cleared, list ID number.

Date Release Required 1/29/92

Title: Calculation of the Rapid or Large Leak Rate for LERF Baseline in the 200 East Area

Unclassified Category UC- NA

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Title of Journal: NA

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City/State: NA

Will proceedings be published? ☐ Yes ☐ No

Will material be handed out? NA ☐ Yes ☐ No

Title of Conference or Meeting: NA

CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer Name (printed)	Signature	Date
Classification/Unclassified Controlled Nuclear Information	☐	☑			
Patent - General Counsel	☑	☐	B.D. Williamson	B.D. Williamson	1/31/92
Legal - General Counsel	☑	☐	B.D. Williamson	B.D. Williamson	1/31/92
Applied Technology/Export Controlled Information or International Program	☐	☑			
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Other Program	☐	☑			
References Available to Intended Audience	☑	☐	F. Stone	F. Stone	1/29/92
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Information conforms to all applicable requirements. The above information is certified to be correct.

Author/Requestor (Printed/Signature) Date

W.J. McMahon A J Knapp 1/28/92

Responsible Manager (Printed/Signature) Date

A.J. Knapp A. J Knapp

Intended Audience

☐ Internal ☐ Sponsor ☑ External

INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP

Stamp is required before release. Release is contingent upon resolution of mandatory comments

APPROVED FOR RELEASE OFFICIAL US DOE 2/4/92

Date Received 1-29-92 NS

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SUPPORTING DOCUMENT

1. Total Pages 3

2. Title
Calculation of the Rapid or Large Leak Rate for LERF Basins in the 200 East Area

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WHC-SD-EN-TI-009

4. Rev No.
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5. Key Words

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6. Author
Name: W. J. McMahon
Signature
Organization/Charge Code 81231/PHIAA

7. Abstract

The rapid or large leak rate (RLL) is calculated for LERF basins. The RLL provides an upper limit on the amount of leakage allowed into the drainage layer before the LERF basin must be closed, repaired, or undergo operational changes. The RLL was calculated according to the guidance provided by three EPA documents.

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9. Impact Level 4

10. Authorized Manager's Name
A. J. Knepp
Authorized Manager's Signature

Specify Distribution Limit EXTERNAL

11. RELEASE STAMP

OFFICIAL RELEASE BY WHC
DATE FEB 21 1992
Sta. 21

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Calculation of the Rapid or Large Leak Rate for LERF Basins in the 200 East Area

William J. McMahon

November 7, 1991

The Rapid or Large Leak Rate (RLL) is defined as the maximum leakage that the Leak Detection, Collection, and Removal System (LDCRS) can remove under gravity flow conditions, such that the fluid head within the drainage layer does not exceed the thickness of that layer (EPA, 1987b). If leakage greater than the RLL occurs, then the chance of the hazardous constituents stored in the surface impoundment seeping through the bottom liner and out of the facility greatly increases. The RLL, submitted in support of the Response Action Plan (RAP), provides an upper limit on the amount of leakage allowed into the drainage layer before the facility must be closed, repaired, or undergo operational changes. The RLL is site specific and determined from the design of each facility.

Calculation of the Rapid or Large Leak Rate

Environmental Protection Agency guidance for estimating the Rapid or Large Leak Rate for a land disposal unit is expressed by the equation (EPA, 1987b and 1988),

$$q = hNbk\tan\beta$$

where q is the RLL (ft/s or m/s), h is the allowable hydraulic head in the drainage layer (ft or m), N is the leak frequency ($1/ft^2$ or $1/m^2$), b is the width of the wetted area from a single leak (ft or m), k is the hydraulic conductivity of the drainage media (ft/s or m/s), and ß is the slope of the drainage layer. The difficulty is that little guidance for selecting a value for b is given in EPA (1987b or 1988), and the RLL is linearly dependent on this value. Both references state that more information is necessary before quantitative guidelines can be established. The design example in EPA (1987b) used a value of 5 ft (1.5 m), which was indicated to be a reasonable value, and the example in EPA (1988) calculated RLL values using three values for b, 3.3 ft (1 m), 5 ft (1.5 m), and 6.6 ft (2 m). Assuming that intensive quality assurance monitoring will be performed during the installation of the flexible membrane liner, the standard hole or leak frequency (N) is 1 per acre (1 per 4000 m^2) (EPA, 1987a). Using the value of 5 ft (1.5 m) for b, and given that h equals one foot (0.305 m), tanß equals 0.02, and k equals 0.03 ft/s (0.01 m/s or 1.0 cm/s) from the LERF design specifications (KEH, 1990), the RLL equals 2.1×10^3 gallons per acre per day (gpad) or 2.0×10^4 liters per hectare per day (Ltd).

According to drawing H-2-79590, which shows the plan sections and details for the cell basin bottom liner, the surface area of the LERF basin will be approximately 2.1 acres (0.85 ha). Taking into account the five feet of freeboard specified in the drawing, the total wetted area will be 1.7 acres (0.69 ha). The RLL for the retention basin will total to 3.5×10^3 gallons per day (gpd) or 1.3×10^4 liters per day (lpd) for the design case described in the preceding paragraph.

Because the RLL value is linearly dependent on each of the input parameters and little guidance is provided by the EPA to determine b, table 1 shows the RLL sensitivity analysis for the values of the three wetted area widths previously listed. The table also includes RLL values calculated for a range of hydraulic conductivities since the statement of work expressed some uncertainty about the value given to this parameter in the Conceptual Design Report (KEH, 1990). In the absence of any further guidance from the EPA, the value of 5 feet for b appears reasonable. The value for k should be determined from the hydraulic characteristics of the drainage media.

Table 1. Rapid or Large Leak Rates for various values of the wetted width (b) for a single leak and the hydraulic conductivity (k) of the drainage media.

b (ft)	k (cm/s)	RLL Per Unit Area (gpad)	RLL Overall (gpd)
3.3	1.0	1400	2300
3.3	0.5	710	1200
5.0	1.0	2100	3500
5.0	0.5	1100	1800
6.6	1.0	2800	4700
6.6	0.5	1400	2300

References

1. Kaiser Engineers Hanford, 1990. *Conceptual Design Report for 242-A Evaporator and PUREX Interim Retention Basin.* WHC-SD-W105-CDR-001.

2. U. S. EPA, 1987a. *Background Document on Bottom Liner Performance in Double-Lined Landfills and Surface Impoundments.* EPA/530-SW-87-013.

3. U. S. EPA, 1987b. *Background Document on Proposed Liner and Leak Detection Rule.* EPA/530-SW-87-015.

4. U. S. EPA, 1988. *Seminars-Requirements for Hazardous Waste Landfill Design, Construction and Closure.* CERI-88-33.